



Science Opportunities on Early Spallation Neutron Source Instruments

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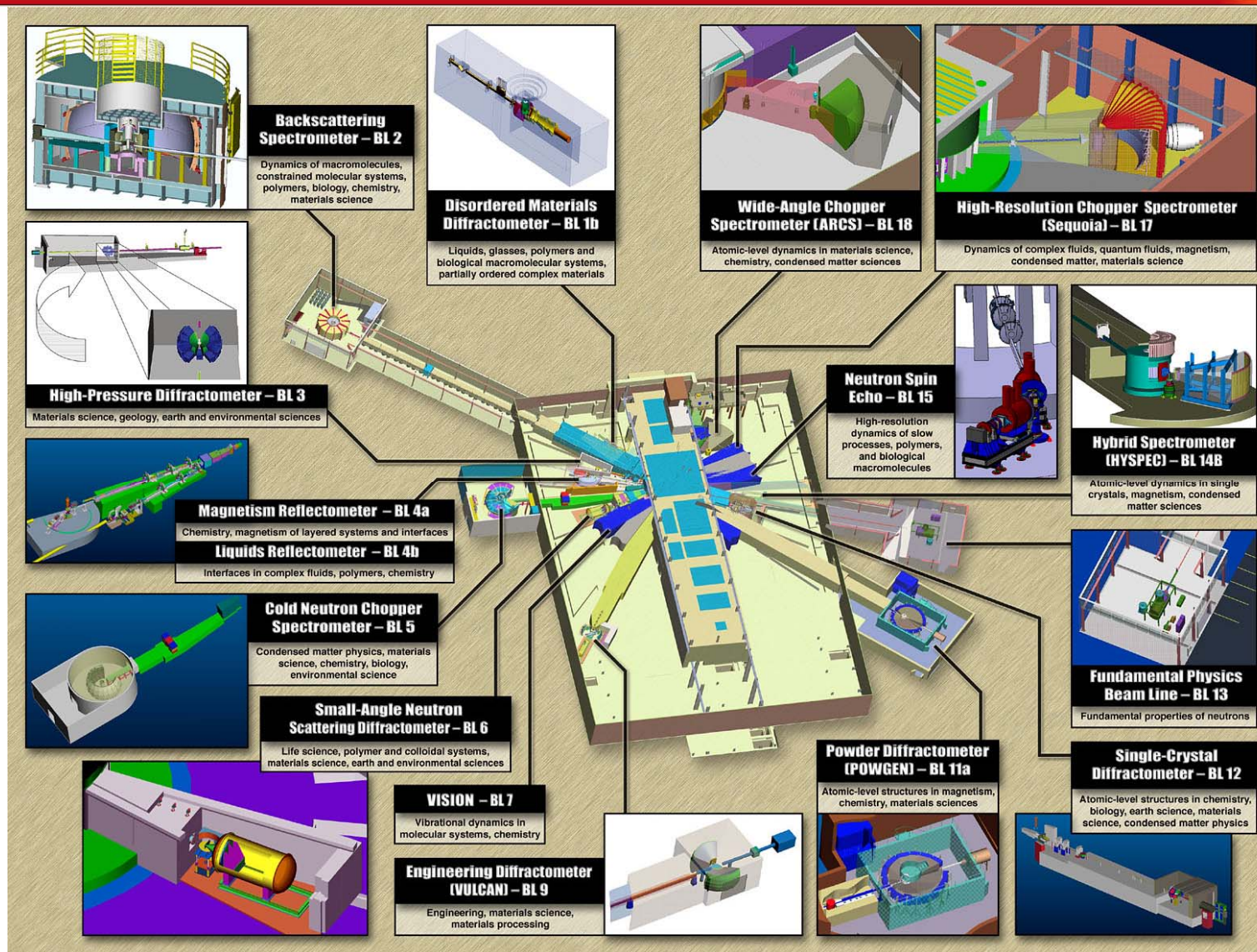
October 8, 2004

The Spallation Neutron Source

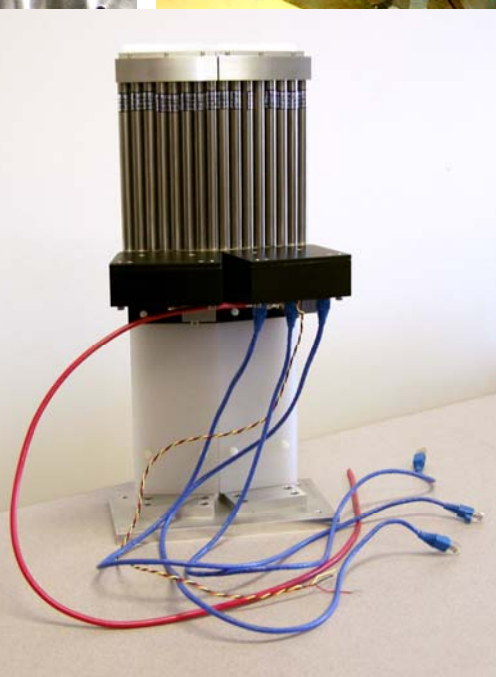


- The SNS will begin operation in 2006 in Oak Ridge, Tennessee
- At 1.4 MW it will be ~8x ISIS, the world's leading pulsed spallation source
- The peak thermal neutron flux will be ~20-100x ILL
- Initial facility will have 1 target station with 24 instruments
- An upgrade to 3-4 MW and a second target station is planned
- SNS will be a short drive from HFIR, a reactor source with a flux comparable to the ILL

Instrument Suite



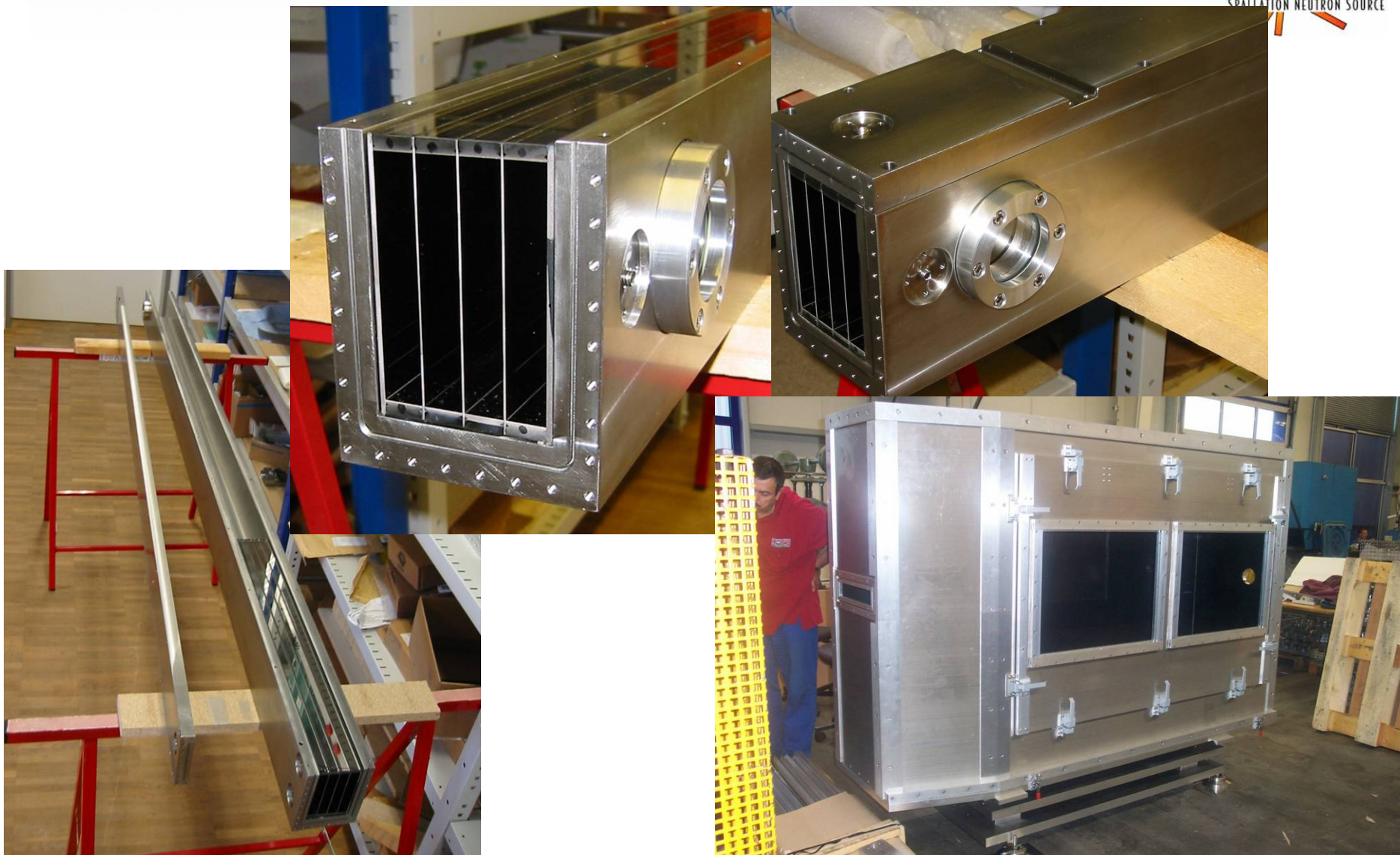
Backscattering Spectrometer Installation



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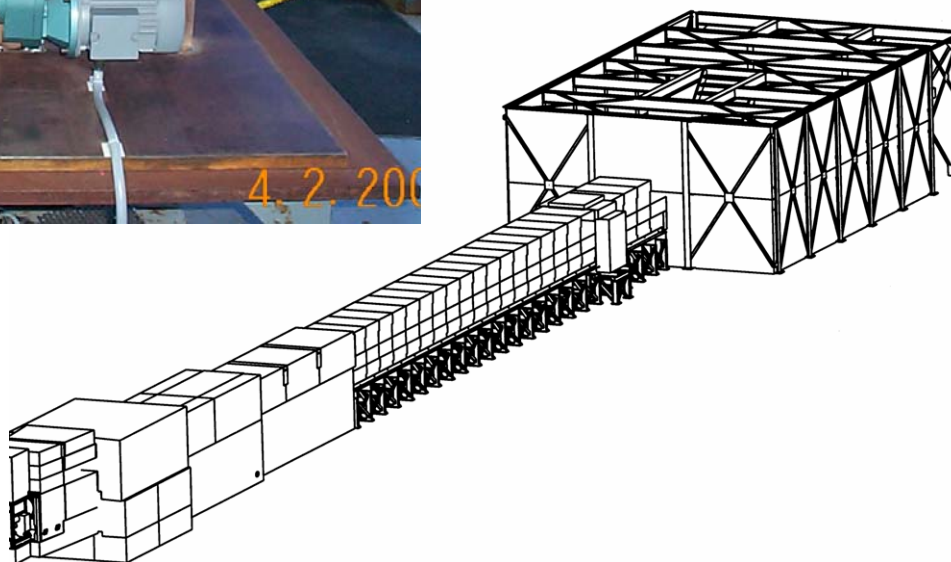
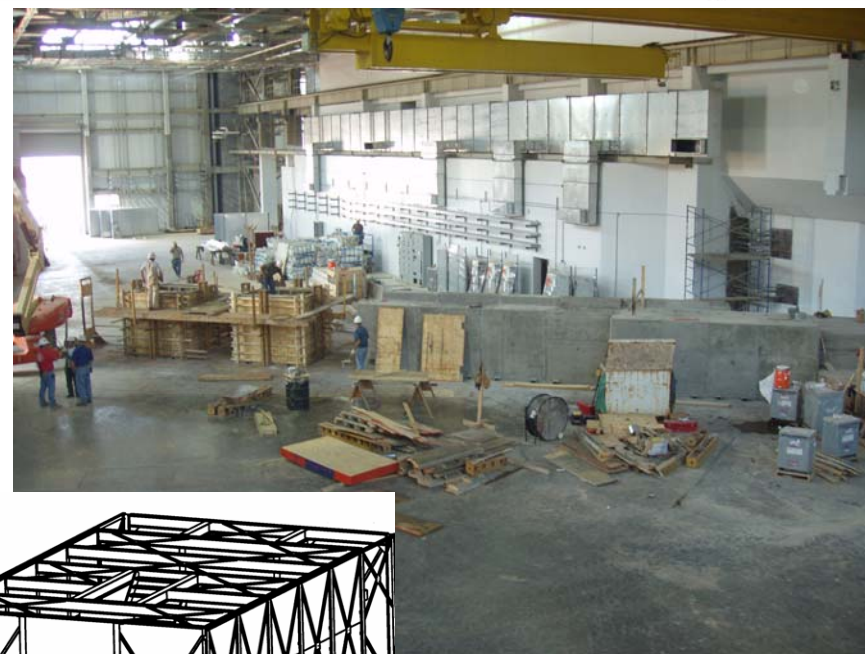


Reflectometer Components



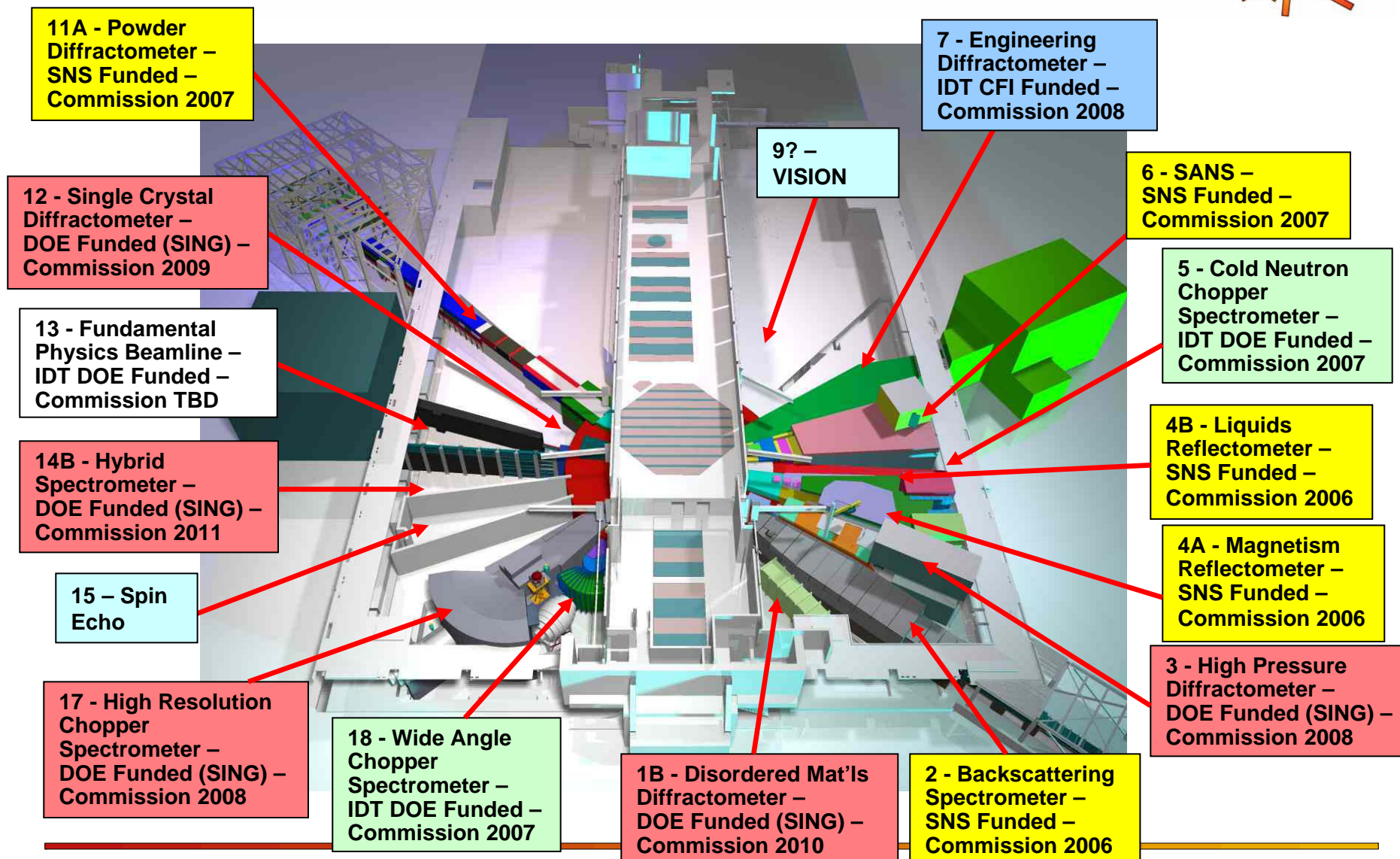
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POWGEN3 Components

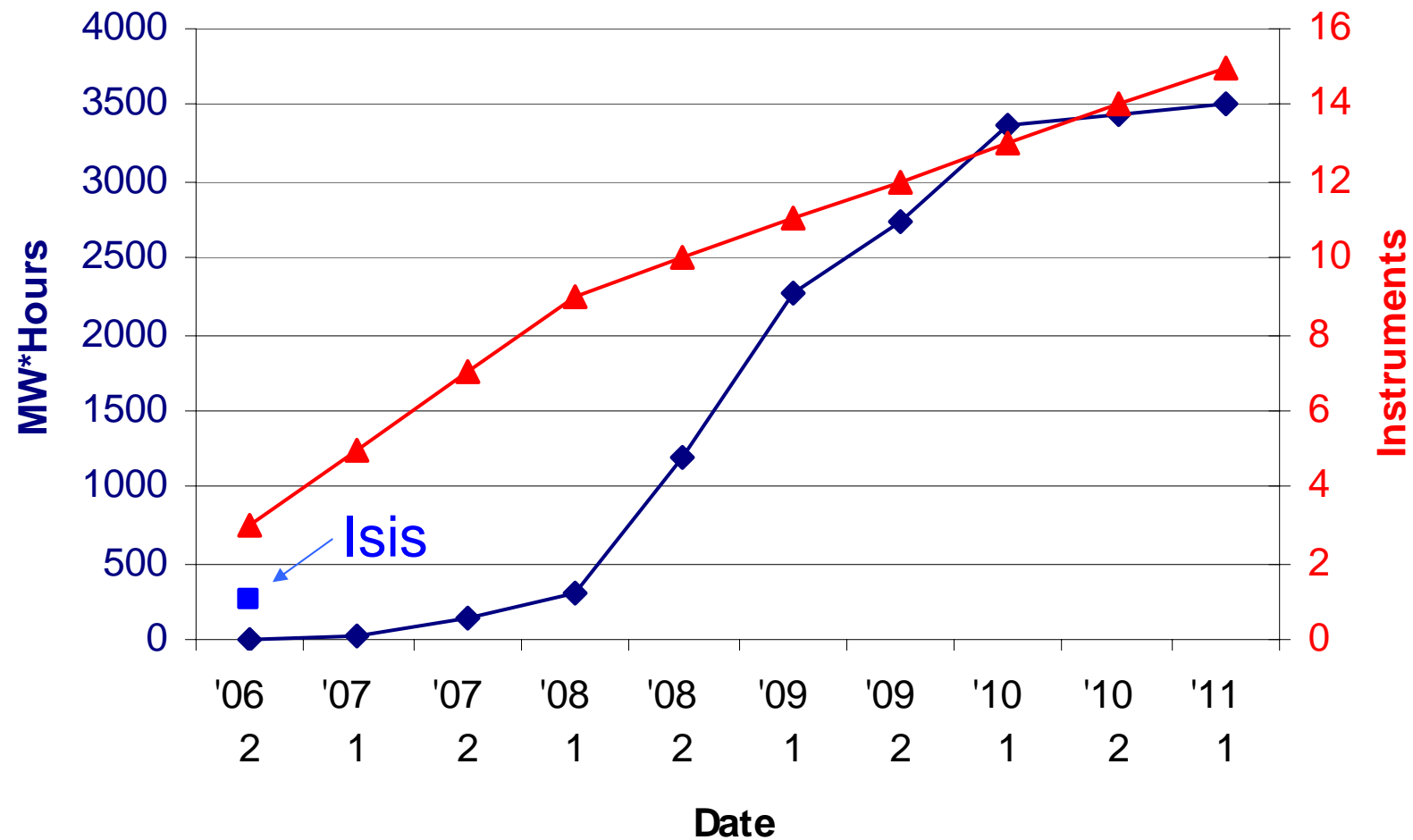


Instrument Layout

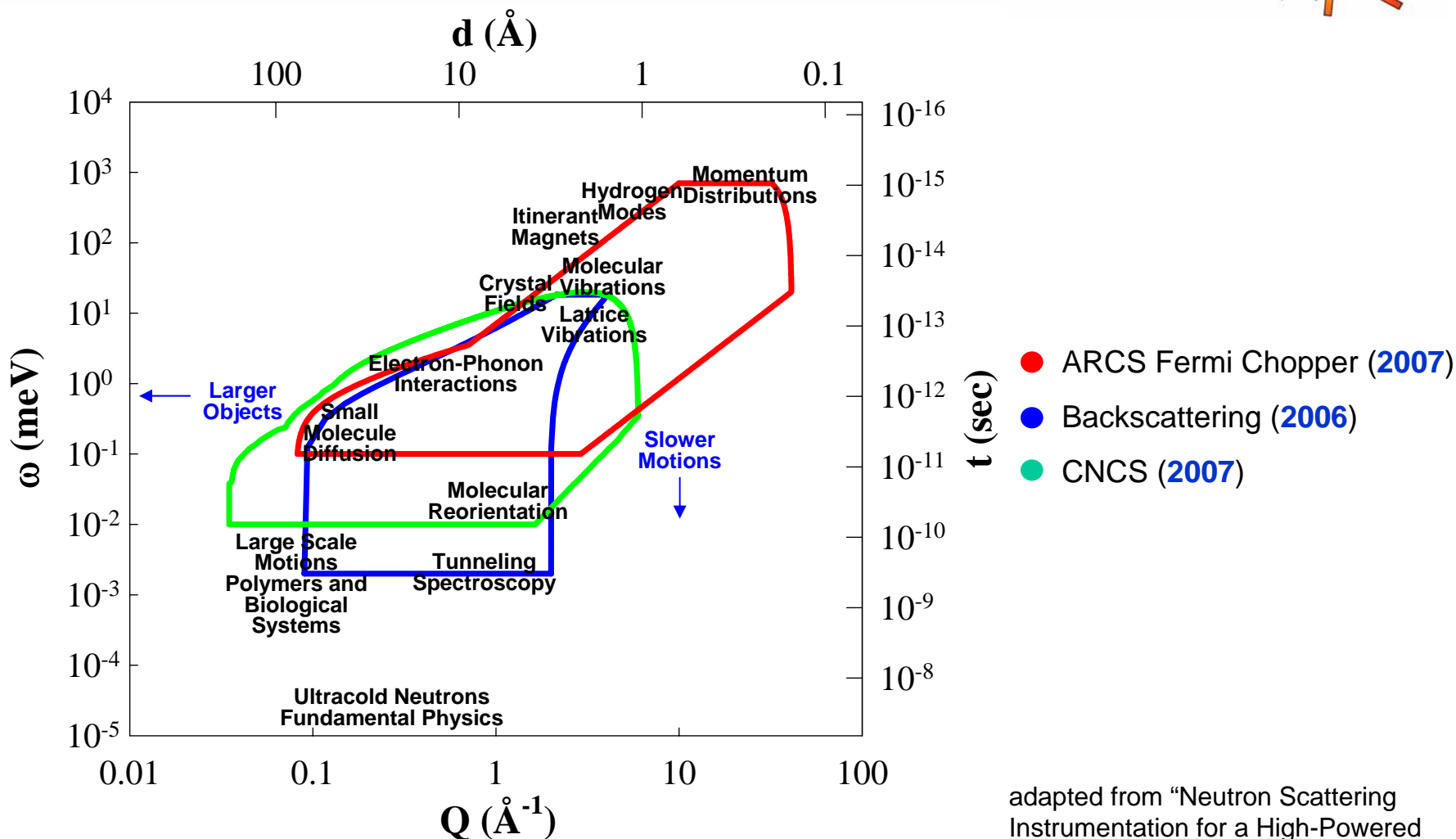
SNS		SING	
UNIV		NUC-PH	
CANADA		Other	



Timeline for scientific productivity

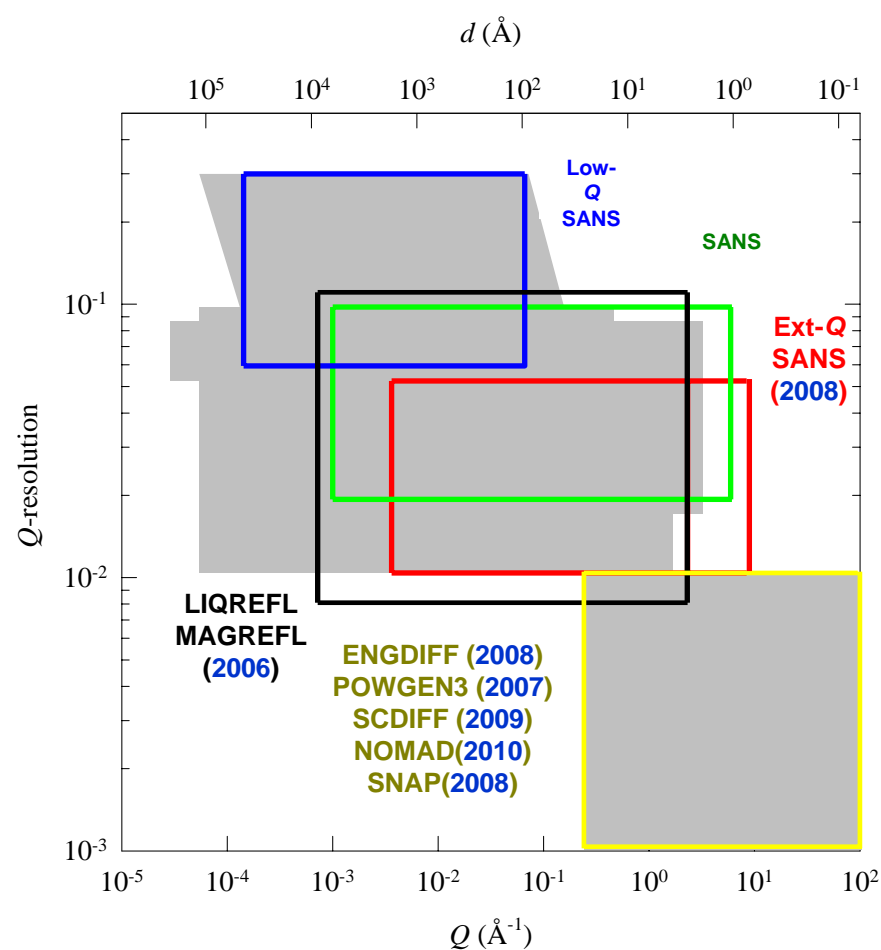
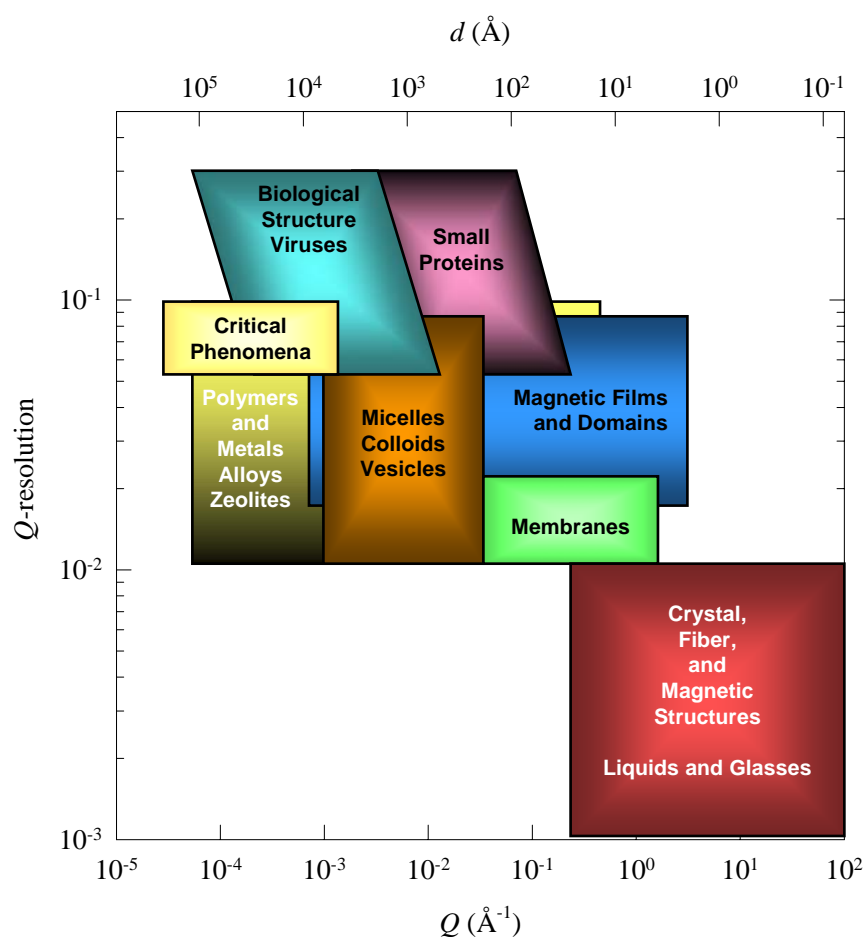


Phase Space probed by Inelastic Instruments



adapted from "Neutron Scattering Instrumentation for a High-Powered Spallation Source" R. Hjelm, et al., LA0-UR 97-1272

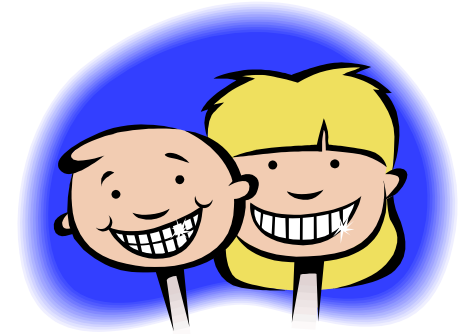
Phase Space probed by Elastic Instruments



Characteristics of Friendly Users



- **PATIENT** – Intermittent performance of Instrument/Target/Accelerator
- **ENGAGED** – Interested in participating in debugging instruments/software
- **MOTIVATED** – Getting the data may take more effort than usual
- **LOW MAINTENANCE SAMPLES** – may need to stay in beam for extended periods of time, limited sample environment equipment in 2006



EXCITING SCIENCE

Unique Features at Low Power/Duty Cycle (pre-January 2008)



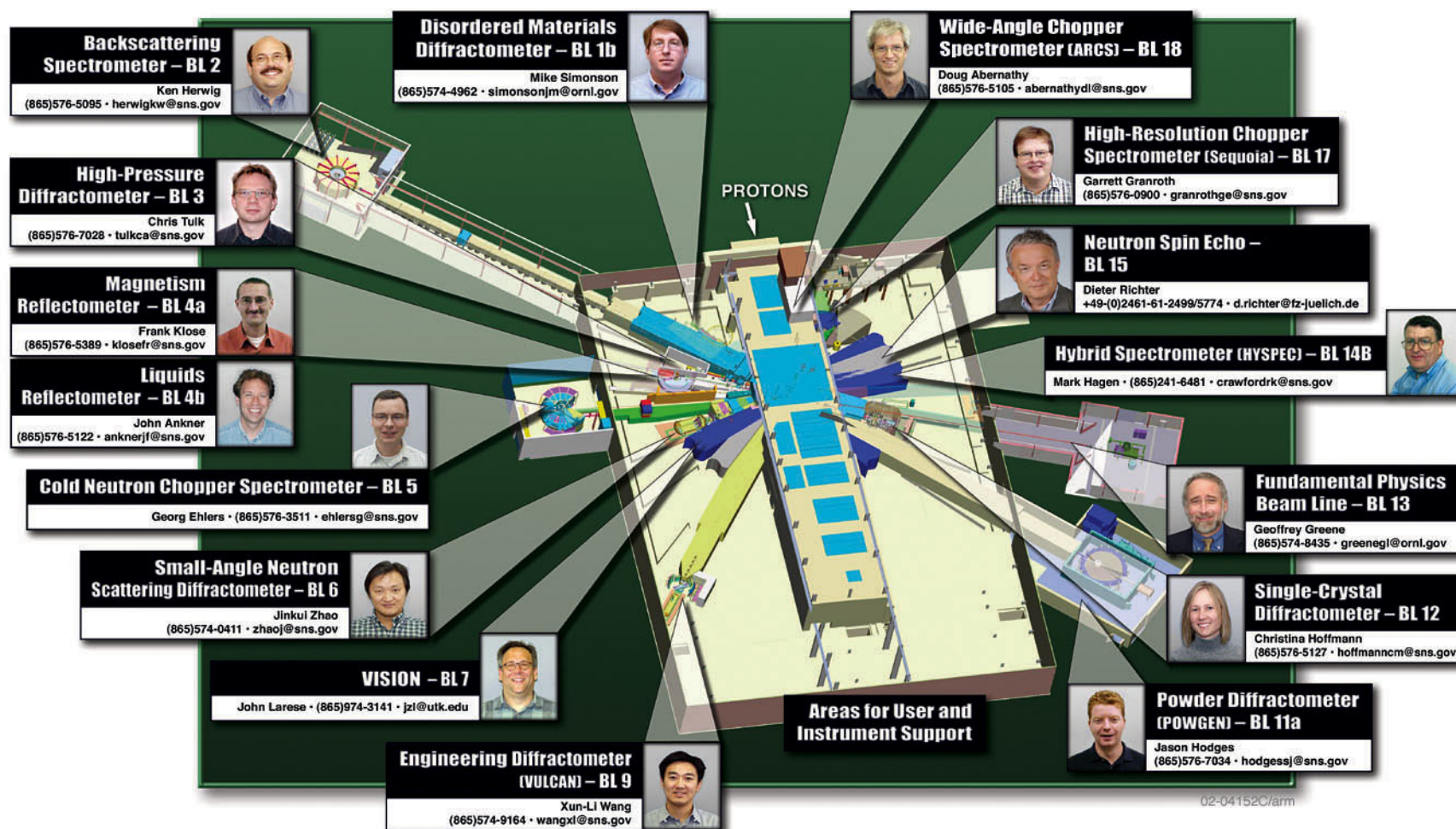
- World class accelerator performance in Early 2008
- Instrument designs typically multiplied source power gains by factors of 2 to 10
 - Capable of world class science prior to 2008
- Early Capabilities
 - Backscattering Spectrometer
 - Wide dynamic range enables study of dynamics over energy transfer range of 2 μeV to ~ 18 meV (~ 4 decades) – glass/amorphous materials dynamics
 - Reflectometers
 - Flexible Data Acquisition System allows “pump-probe” techniques – application of external fields and measured response on ~ 1 minute time resolution
 - Time-of-flight coupled with area detectors facilitates off-specular reflectivity – in-plane structures, magnetic domain formation, nano-patterned films

Unique Features at Low Power/Duty Cycle (pre-January 2008) #2



- Early Capabilities
 - ARCS (Fermi Chopper – inelastic spectrometer)
 - Wide detector angular range/position sensitive – elastic diffuse scattering
 - Density of states vs. T and P (large powder samples)
 - CNCS (Cold Neutron Chopper Spectrometer – inelastic)
 - Hydrogen diffusion in membrane materials
 - Wide angular range/position sensitive detector – elastic diffuse scattering
 - POWGEN3 – (general purpose diffractometer)
 - High Resolution ($\Delta d/d \sim 0.15\%$) – ab initio structure determination
 - Fastest U.S. neutron powder diffractometer
 - Large samples – parametric studies, T, P, pO_2

16 Instruments are formally approved



CONCLUSION



- Web sites for the Spallation Neutron Source
 - www.sns.gov – project public site
 - Follow links to user information and to instrument data sheets
www.sns.gov/users/instrument_data_sheets.pdf
 - Follow links to ORNL Neutron Scattering Points of Contact (HFIR and SNS) personnel
http://www.sns.gov/users/points_of_contact.pdf
- Instrument Commissioning
 - 3 in 2006
 - 5 more in 2007
 - 2 more in 2008
- Late 2007 – Early 2008: at ISIS MWatt * Hours level
- Opportunity for Friendly Users as instruments go through commissioning
- User Program Experiments – 2nd Half 2007